REMARKS

The Office Action dated September 16, 2002, has been received and carefully noted. The above amendments to the claims and title, the substitute drawings and the following remarks, are submitted as a full and complete response thereto. Additionally, Applicants have also submitted a non-prior art reference that the Office may find helpful in understanding the invention.

In the prior Office Action, the title of the present invention was objected to as allegedly not being clearly indicative of the claimed invention. A new title is included herewith that is respectfully submitted to be indicative of the claimed invention. Reconsideration and withdrawal of the above objection are respectfully requested. The drawings, specifically Figs. 1a and 5, were objected to because those figures allegedly did not clearly and distinctly illustrate connection dots between lines of the schematic between elements thereof. Applicants have provided substitute drawings that add the connection dots where the Office Action asserted them to be missing. Approval of the substitute drawings is respectfully requested.

Claims 1-28 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. The rejection of claims 1-14 is respectfully considered to be moot following the cancellation of those claims. With respect to the non-cancelled claims, claims 18-21 and 24-26 were rejected because elements of those claims lacked proper antecedent basis. Claims 18-21 and 24-26 have been amended such that they now comply with 35 U.S.C. § 112, second paragraph. The Office Action also indicated that claim 25 was indefinite and

should depend from claim 18. Claim 25 has been amended and now depends from claim 18.

Additionally, the Office Action indicated that claims 15-27 were vague and indefinite because it was alleged that (non-amended) claim 15 and (non-amended) claim 17 supposedly conflict with each other in their recitations of the primary and secondary windings and the direction of the magnetic flux produced by them. This portion of the rejection is respectfully traversed according the remarks that follow.

As illustrated in Fig. 5, switch B is switched on an instant $1.5*10^{-6}$ and primary current will flow in from the dotted ends of the primary winding; i.e. a direct component of the current and a half of an alternating component will flow through windings P1 and P2, and another half of the alternating component will flow through windings P3 and P4. This current will produce a magnetic flux in side leg MS1, the direction of which will be upwards as is known in the art. This current will further produce a magnetic flux in side leg MS2, the direction of which will be downwards, as is known in the art.

The direction of the voltages induced in the secondary windings S1 and S2 is such that only rectifier A' will be able to conduct forward secondary current, whereas for rectifier B' the voltage of the secondary winding will be reverse. The current flowing through S2 will produce its own magnetic flux in side leg MS2, the direction of which will be upwards and the magnitude of which will be twice that of the flux produced by the primary windings P2 and P4 (the direct component of the flux).

Thus, an equal (direct component) magnetic flux will flow in both side legs upwards. The center leg will serve as a return path in a closed magnetic circuit. The returning fluxes will be flowing downwards in the center leg. The filter coil of the center leg will produce a flux of its own in the center leg, the direction of which will also be downwards as is known in the art.

Thus, Applicants respectfully assert that claims 15 and 17 are correct in disclosing that the magnetic flux produced by the primary and secondary windings around the side legs flows in the same direction as the magnetic flux produced by the filter coil; and that the magnetic fluxes produced by the primary and secondary windings around the same side leg flow in opposite directions. Based on the above, Applicants respectfully request reconsideration and withdrawal of the rejection of the claims as they presently stand.

The Office Action also made several rejections of the claims over prior art. Claims 1, 3, 14, 15, 17 and 28 were rejected under 35 U.S.C. §102(b) as being clearly anticipated by *Cielo et al.* (U.S. Patent No. 3,694,726). Claims 1, 3, 10, 12, 14, 15, 17, 24, 26 and 28 were rejected under 35 U.S.C. §102(b) as being clearly anticipated by *Bloom* (U.S. Patent No. 4,864,478 or 4,961,128). Claims 2, 4-7, 11, 13, 16, 18-21, 25 and 27 were rejected under 35 U.S.C. §103(a) as being unpatentable over either *Cielo et al.* or *Bloom*. Claims 8 and 22 were rejected under 35 U.S.C. §103(a) as being unpatentable over either *Cielo et al.* or *Bloom* in view of *Barrett* (U.S. Patent No. 5,737,203). Claims 9 and 23 were rejected under 35 U.S.C. §103(a) as being unpatentable over either *Cielo et al.* or *Bloom* in view of *Morris* (U.S. Patent No.

5,555,494). The above rejections are respectfully traversed according to the remarks that follow.

The present invention is directed to, as embodied in independent claim 15, a chopper-type direct-current converter. The converter includes a magnetic core, which has a first and a second side leg, the ends of which are connection to each other with end pieces and a center leg provided with an air gap and connected to the end pieces between the first and second side legs. Around the magnetic core are arranged a primary winding, a secondary winding and a secondary side filter coil. The filter coil is wound around the center leg and the primary and secondary windings are wound around the side legs so that the magnetic flux produced by them flows in the same direction as the magnetic flux of the filter coil.

The present invention is also directed to, as embodied in independent claim 28, a chopper-type regulator. The regulator includes a magnetic core, which includes a first and a second side leg, the ends of which are connected to each other with end pieces and a center leg provided with an air gap and connected to the end pieces between the first and second side legs. Around the magnetic core are arranged two windings and a filter coil. The filter coil is disposed around the center leg and the windings are disposed around the side legs so that the magnetic flux produced by them flow in the same direction with the magnetic flux of the filter coil.

Applicants respectfully assert that the above referenced magnetic fluxes provided by the various windings and their directions are what constitute a core idea of the present

invention. Applicants respectfully assert that both *Cielo et al.* or *Bloom* fail to teach or suggest such an arrangement.

Additionally, *Cielo et al.* discloses a typical push-pull DC-DC-converter that has an integrated magnetic component. *Cielo et al.* discloses two different solutions to provide maximum efficiency for the converter. In the first (fig 1), the primary windings operate in the alternating shifts around their own side legs. The phases of the secondary windings are so arranged that the load current is coupled to the secondary winding around the different side leg than the primary winding. The sum flux of the primary and secondary currents stores energy into the air gap during the active state of the one of the two transistors. This energy discharges between the active states through own diode (D3) to the load. The disadvantage of this solution is the poor coupling between the primary and secondary winding, which decreases the energy coupling and increases the energy of the stray inductance. This in turn can be seen as a high current peaks on the collectors of the transistors when the primary current is turned off.

The second solution by *Cielo et al.* tries to solve the above described problems of the first solution. The second solution is known as a current coupled push-pull topology that is well known in the art. In this solution the energy is stored into the air gap using the different principle than in the first solution. The primary current flows always through winding N4 whenever the other of the two transistor is in active state storing the energy that discharges through winding N3 and diode D3 between the active states of said transistors.

The present invention, on the other hand, discloses a chopper-type direct current converter that comprises a magnetic core that further comprises a first and a second side legs, the ends of the which are connected to each other with end pieces, and a center leg provided with an air gap and connected to the end pieces between the first and the second side legs around which magnetic core are arranged. The filter coil is disposed around the center leg and the primary and secondary windings are disposed around the side legs so that the magnetic flux produced by the windings flows in the same direction with the magnetic flux of the filter coil.

The advantages of the claimed invention include the fact that the power source can be designed around a single standard type magnetic core. This allows considerable advantages to be achieved both in design and in manufacture. The solution presented allows more effective utilization of the capacity of the magnetic flux density. Reducing the number of separate filter coils decreases the size of the power source and therefore improves its power density. At the same time, the magnetic core can be relatively effectively utilized. In large production quantities, significant cost savings in core material are achieved.

All of the solutions above have certain common things. The primary goal to achieve is an isolated DC-DC converter using an integrated component that ha both transformer and coil. Also each of them has an E-type core with three legs, primary and secondary windings arranged around the side legs and one or tow windings around the center leg. However, in the present invention the electrical function of the coupling is

different than in prior art. As such, Applicants respectfully assert that the rejection of independent claims 15 and 28 are improper for failing to teach or suggest all of the elements of those claims.

Similar to the above discussion, *Bloom '128* discloses two-stage, current-coupled, switched-coil buck pre-regulator power-part topology followed by a 50% / 50% isolating push-pull stage. Applicants respectfully assert that the principle discussed in the *Bloom '128* reference is itself known and has been commonly used. The isolating push-pull stage uses the side legs of a magnetic circuit as if one leg was a push-converter for one half-cycle, and the other leg was a push-converter for the other half-cycle. Even assuming such a configuration works as disclosed, it is disadvantageous when compared to a standard E-type ferrite core in which the cross section of the center leg is twice that of the side legs.

In the configuration of *Bloom '128,* if the primary and secondary windings of a converter are located on the center leg, their return flux will be divided to the side legs in half. However, if the windings of a converter are located on the side legs, the total flux will have to pass via a side leg. Applicants respectfully assert, however, that the disclosure of *Bloom '128* has little relevance to the present invention, as discussed with respect to *Cielo et al.* above.

Additionally, *Barrett* and *Morris* were cited in the rejection of claims 8, 9, 22 and 23, but those references do not teach or suggest the structure of the elements provided in independent claims 15 and 28. Similarly, the rejection of claims 16-27 should likewise

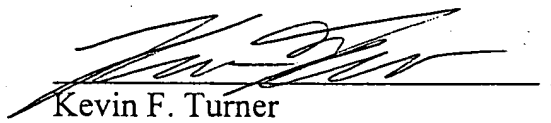
be improper for at least their dependence on claim 15. Lastly, Applicants respectfully request reconsideration and withdrawal of all of the rejections that claims 15-28 be allowed and that the application be allowed to pass to issue.

Lastly, Applicants wish to direct the Office's attention to the paper authored by Liang Yan et al. which discusses a filter coil disposed around the center leg to aid in the Office's understanding of the present invention.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,



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